

P-2.7 Use a free-body diagram to determine the net force and component forces acting upon an object.

Revised Taxonomy Level 3.2 C_A Apply (use) procedural knowledge

Key Concepts

Effective force

- ❖ In Physical science students determined the net force acting on an object only in the case of forces acting in the same or opposite directions.
- ❖ Students were not required to represent the forces in vector diagrams.

As Physics for the Technology classes and traditional college prep classes will have different curricula based on the choices that are made for standards six through ten, the scope of the core curriculum should vary as well. The emphasis of topics within the core standards will depend on subsequent topics to be addressed.

It is essential for all students to

- ❖ Illustrate the forces acting on an object using a vector diagram when given a verbal description or data.
 - Draw force vectors in the appropriate direction and representing the magnitude of the force
 - The **effective forces** (forces which influence the motion) are in the same or the opposite direction of the motion.
 - If any of the given forces are not in the same or opposite direction as the motion but have a component in the same or opposite direction as the motion,
 - ◆ use vector analysis to determine the magnitude of the effective component of the given force (either analytically or by graphic analysis)
 - ◆ draw the effective component of the force
 - From the diagram, determine the magnitude and direction of the net force acting on an object
 - Use the net force to solve problems involving the motion of the object
 - Examples include
 - ◆ An object being pulled horizontally with friction opposing the motion
 - ◆ An object (like a lawn mower) being pushed at a particular angle with the ground, with friction opposing the motion.
 - ◆ An object (like a lawn mower) being pulled at a particular angle with the ground, with friction opposing the motion.
 - ◆ An object projected upward with a constant force (such as a rocket engine) with the gravitational force opposing the motion

College prep differentiation

❖ Consider

- Objects sliding down a ramp with friction opposing the motion
- Objects being pulled up a ramp with friction opposing the motion

Assessment

As the verb for this indicator is implement (use), the major focus of assessment will be for students to show that they can “apply a procedure to an unfamiliar task”. The knowledge dimension of the indicator, procedural knowledge means “knowledge of subject-specific techniques and methods” In this case the procedure for using a free body diagram to determine the net force acting on an object and the equations which apply to the motion of an object. The unfamiliar task should be a novel word problem or laboratory investigation. A key part of the assessment will be for students to show that they can apply the knowledge to a new situation, not just repeat problems which are familiar. This requires that students have a conceptual understanding of each of the forces and an understanding of how the components of a force are related to the resultant force. Mastery of the skills required to implement the mathematical equations in order to solve the problem are also essential procedures.